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EFFECT OF PLACENTAL RETENTION TIME AND ASSOCIATED TREATMENTS ON REPRODUCTIVE PERFORMANCE IN HEAVY DRAFT HORSES

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SUMMARY

The effect of placental retention time on reproductive performance was investigated in several heavy draft breeds of horses. The study was based on a total of 422 mares varying from four to 20 years in age, which had foaled during the period 1991 to 1994. The placental retention time for this group of mares ranged from a minimum of 119 minutes to a maximum of 183 minutes with a mean of 148 minutes. A decrease in pregnancy rate followed on breeding at the foaling heat in mares that had a placental retention time greater than one hour. Mares with a placental retention time of less than one hour or longer than four hours had pregnancy rates of 66% and 51.7%, respectively, when bred on their foaling heat. Manual removal of a retained placenta was subsequently associated with reduced reproductive performance in those mares. Mares with a placental retention time of less than four hours and which had received oxytocin treatment, had a pregnancy rate at foaling heat of greater than 70%. Where oxytocin treatment was delayed, on the other hand, the number of days from parturition to last breeding date was correspondingly increased. Aerobic bacteria were cultured from the uterus in 47.2% and 100% of mares whose placental retention times were less than eight hours or greater than eight hours, respectively. The subsequent reproductive performance of mares with a placental retention time of greater than four hours was improved if the uterus was irrigated. The findings of this study indicate that rapid administration of oxytocin administered at a dosage 50 IU is the best treatment for retained placenta and the application of intrauterine treatments such as uterine irrigation in prolonged cases of placental retention is likely to improve subsequent breeding efficiency.

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INTRODUCTION

Retention of the placenta following parturition can be a significant problem in foaling mares. The frequency of this condition, though difficult to assess, has been reported to occur in 2 to 10.5% of foalings.[1] Retention of the placenta is particularly common in horses of the draft breeds,[2] after dystocia,[1] prolonged gestation[3] or in cases of hydrops fetus.[4] Expulsion of the placenta should normally occur within three hours after foaling, with a mean of approximately one hour.[4,5] Manual removal of a retained placenta should not be attempted within 12 hours of foaling.

Oxytocin treatment for retained placenta is maximally effective when treatment is instigated within four to 12 hours after foaling. The recommended dosage of the drug is 40 to 100 IU administered subcutaneously[6] or intramuscularly[7] every two to three hours. Similar results were obtained using 100 IU of oxytocin in 500 ml of physiological saline administered intravenously over a period of several hours.[8]

Mares which have had retained placenta can be bred on their foaling heat provided no residual uterine abnor-

malities are detected on rectal palpation. Little published information is available on the effect that placental retention can have on subsequent breeding performance. The present study was, therefore, undertaken to investigate the possible effect that manual removal of the placenta, oxytocin treatment or intrauterine treatment for retained placenta can have on the pregnancy rate following breeding at foaling heat and on the interval to establishment of pregnancy.

MATERIALS AND METHODS

The study was conducted in Eastern Hokkaido, Japan during the period 1991 to 1994. A total of 422 mares varying from four to 20 years in age and located on 54 farms were included in this study. The mares were purebred or of mixed breed and belonged to Breton, Percheron or Belgian Draft horse breeds. All of the mares were delivered and the placental retention times were checked. They were divided into different groups based on age, treatment received, presence or absence of bacterial endometritis and the year in which retention of the placenta occurred. Natural breeding was used in all mares. A total of 264 mares were mated at the foaling heat. Based on statistical analysis done on the mating list, the mares bred up to 21 days after foaling were used in calculating the pregnancy rate following breeding at the foaling heat. (Fig. 1.) Non-pregnant mares and non-mating mares at the foaling heat were mated at following estruses until conception. The reproductive performance of each mare was recorded in detail during the period of the study. Each pregnancy rate at the foaling heat and mean number of days from parturition to last mating (non-pregnant term) were compared by different years, levels of placental retention times, bacterial presence, and various treatments. Excluded from the calculations of mean number of days from parturition to last mating were non-pregnant mares during the year and mares not mated at the foaling heat due to circumstances inconvenient to the owner (i.e., the mating result would be too early for delivery in the next season). Mares were checked for pregnancy fourteen to 40 days after breeding by ultrasound examination. In the oxytocin treated group, mares that did not expel the placenta within a few hours after foaling were given 50 to 100 IU of oxytocin intramuscularly at two-hour intervals until the placenta was expelled.

Intrauterine swabs were taken from a total of 63 mares with likely abnormal mucus or longer placental retention time, six to 15 days after foaling and before they were bred, the swabs were examined bacteriologically. Swabs were plated on blood agar plates containing 5% sheep blood and incubated aerobically at 37°C for 48 hours. Bacterial colonies were identified based on colonial morphology, patterns of hemolysis, catalase reaction, and Gram stain characteristics. Staphylococci were identified as *Staphylococcus aureus* (SA) or coagulase negative staphylococci (CNS) by the coagulase test. Streptococci and gram-negative bacilli were not identified as to species. Mares positive on bacteriological examination were divided into three groups based on the type of treatment used to combat the infection. Three different treatments were used: uterine irrigation+antibiotics, intrauterine infusion with antibiotics, and a third group was left untreated. The antibiotics used for intrauterine infusion were Ampicillin (2g) and Cloxacillin (2g) in 500ml of physiological Ringer's solution. For uterine irrigation, 20L of physiological saline was used and the treatment repeated one to three times at two day intervals. A uterine infusion of the aforementioned antibiotics was administered after uterine irrigation.

The results of this study were analyzed statistically. Each value (mean or proportion) was tested by a pair. Differences in mean values were tested by *t*-distribution and differences in proportion were tested on a 2 x 2 contingency table by X^2-distribution.

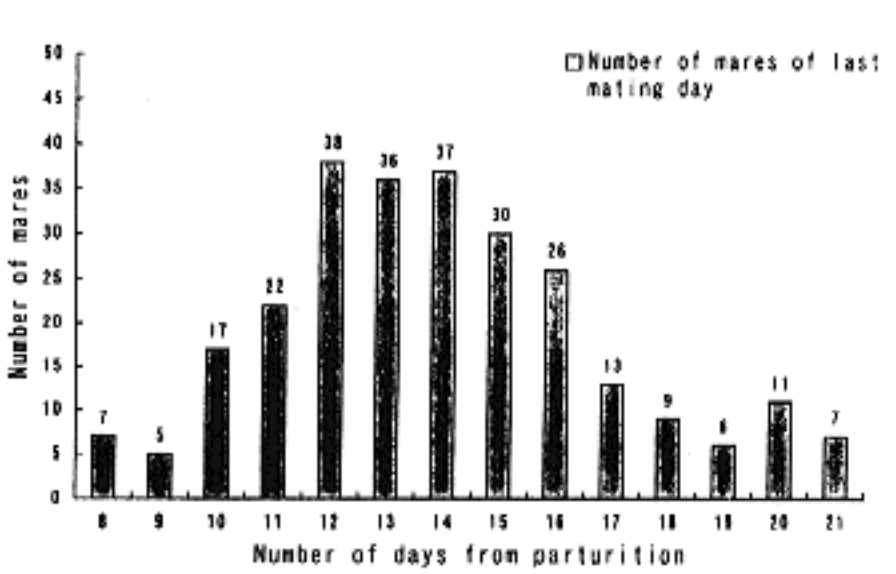

Figure **1.** Distribution of number of mares by last mating day at foaling heat. Number of mares shows the normal distribution with the mean of **14** days.

RESULTS

Placental retention time

The mean placental retention time in the mares included in this study was 148 minutes. Mares from which

Table **1.** The relationship of placental retention time with age of the mare

Age (Year)	Number of mares	Placental retention time (Min.)
5 >	126	143
6—10	191	148
11—15	79	155
16 <	15	156

Table **2.** Placental retention times in relation to pregnancy rates at foaling heat and number of days from parturition to last mating

Year	Mean placental retention time (min.)	Pregnancy rate at foaling heat (%)	Mean no. of days from parturition to last mating (day)
1991	119[a] *n*107	68.3[a] *n*60*	31.7[b] *n*95**
1992	183[a] *n*93	44.8[a] *n*58	39.9[b] *n*76
1993	161 *n*112	65.2 *n*69	30.4 *n*97
1994	140 *n*99	61.6 *n*73	34.2 *n*91
4 years total	148 *n*411	60.4 *n*260	33.8 *n*359

*Number of mares bred at foaling heat.
**Number of mares detected pregnant at 14-40 days by ultrasound examination.
[a,b] Significant differences between values for 1991 and 1992: a's at significance level p = 0.01; b's at significance level p = 0.05.

Table **3.** Effect of placental retention time on pregnancy rate on breeding at the foaling heat and on the number of days from parturition to last mating.

Placental retention time (hr.)	Pregnancy rate at foaling heat (%)	Mean no. of days from parturition to last mating (day)
<1 *n*136	66.0[a] *n*97*	30.3[b,c]
1—4 *n*155	59.6[a] *n*109	35.1[b]
>4 *n*101	51.7[a] *n*58	38.6[c]

*Number of mares bred at foaling heat.
[a]Pregnancy rates are significantly different between each of them (p=0.05).
[b,c]Mean days to establishment of pregnancy: significant differences between b's (p=0.05) and c's (p=0.01).

this calculation. While the mean placental retention time was slightly greater in older mares, differences among the various age groups were not significant (Table 1). On the other hand, comparing placental retention time by year, it was found that the mean retention time in 1992 (183 minutes) was significantly higher at a significance level (s. l. of p=0.01) than that in 1991 (119 minutes). Significant differences were also observed between these two years both in the pregnancy rate following breeding at the foaling heat (s. l. p=0.01) and in the number of days from parturition to last mating (s. l. of p=0.05) (Table 2). In mares with an extended placental retention time, the number of days from parturition to last mating significantly increased (s. l. of p=0.01) and the pregnancy rate following breeding at the foaling heat was reduced significantly (s. l. of p=0.05) (Table 3).

Table **5.** Effect of time of initiation of oxytocin treatment on the pregnancy rate and the number of days from parturition to last mating in mares with different placental retention times

Time of onset of oxytocin treatment (hr.)	Pregnancy rate at foaling heat (%)	Mean no. of days from parturition to last mating (day)
2 *n*21	64.7 *n*17*	25.1[ab] *n*18**
2—4 *n*59	60.0 *n*40	35.8[a] *n*58
>4 *n*16	50.0 *n*6	38.8[b] *n*13

*Number of mares bred at foaling heat.
**Number of mares confirmed pregnant when ultrasounded at 14-40 days.
[a,b]Mean no. of days to establishment of pregnancy: differences between a's (p=0.01); between b's (p=0.05).

Manual removal of the placenta

Of the group of mares in which the retained placenta was removed manually (n=10), eight were bred at the foaling heat. The pregnancy rate following breeding at the foaling heat was 50%, but the number of days from parturition to last mating (58.5) was greater than was observed in the other groups (33.8).

Oxytocin treatment

A high pregnancy rate following breeding at the foaling heat was observed in the oxytocin treated group (n=63). This was especially the case in mares with a retention time of less than four hours which had a pregnancy rate of greater than 70%. A significant difference in the pregnancy rate following breeding at the foaling heat (s. l. of p=0.05) was recorded in all mares in which the placenta was

Table **4.** Effect of oxytocin treatment on the pregnancy rate on breeding at the foaling heat and on the number of days to establishment of pregnancy in mares with different placental retention times.

Placental retention time (hr.)	Pregnancy rate at foaling heat (%)		Mean no. of days from parturition to last mating (day)	
	Oxytocin	No	Oxytocin	No
<1 *n*116	100.0 *n*2*	69.1 *n*81*	13.5 *n*2**	29.8 *n*108**
1—4 *n*114	72.4[a] *n*29	54.0[a] *n*50	32.1 *n*39	38.5 *n*67
>4 *n*59	46.9 *n*32	33.0 *n*3	37.9 *n*49	36.6 *n*5

*Number of mares bred at the foaling heat.
**Number of mares confirmed pregnant when ultrasounded at 14-40 days.
[a]Pregnancy rate at the foal heat between treatment and control (placental retention time from one to four hours) is only group with a significant difference (p=0.05).

the placenta was manually removed were excluded from

Table **6.** Effect of different uterine treatments on the pregnancy rate and the number of days to establishment of pregnancy in mares with a bacterial uterine infection.

Treatment	Pregnancy rate at foaling heat (%)	Mean no. of days from parturition to last mating (day)
Uterine irrigation + antibiotics	45.5 *n*11*	38.5 *n*17**
Intrauterine antibiotics	50.0 *n*4	32.2 *n*6
No treatment	28.5 *n*7	39.6 *n*7

*number of mares bred at foaling heat.
**Number of mares pregnant on ultrasound examination at 14-40 days.

retained for one to less than four hours. The efficacy of oxytocin treatment decreased, however, in mares with longer placental retention times (Table 4). When the administration of oxytocin treatment was delayed, there was a significant decreased pregnancy rate following breeding at the foaling heat (s. l. of p=0.05) and a significant increase in the number of days from parturition to last mating (s. l. of p =0.01) (Table 5).

Bacteriological findings

Aerobic bacteria were cultured from the uterus of almost 100% of the mares in which the placental retention time was longer than eight hours compared with 47.2% in the group in which the retention time was less than eight hours. Differences between these two groups were significant (s. l. of p =0.05). The bacteria identified in 33 of the culture positive mares were streptococci (64%), coagulase negative staphylococci (27%), *Staphylococcus aureus* (35%), and gram-negative bacilli (6%). The mean placental retention time in the mares that were cultured positive was 234 minutes compared to 157 minutes in the culture negative group. The mean pregnancy rate following breeding at the foaling heat in the culture positive group decreased (40.9%), while the mean number of days from parturition to last mating increased (37.5).

Uterine treatments

In the case of the culture positive mares, the mean pregnancy rate following breeding at the foaling heat in the non-treated group, the uterine irrigated+antibiotics group and the intrauterine antibiotic infused group was 28.5%, 45.5% and 50%, respectively (Table 6).

There was an increased pregnancy rate following breeding at the foaling heat in the uterine irrigated group when the placental retention time was greater than four hours, while there was a reduction in the pregnancy rate in the group with a placental retention time of less than one hour (Table 7).

DISCUSSION

Retention of the placenta in the mare has been thought to be caused by various factors such as placental edema which may prevent normal release of the membranes after foaling,[9] fatigue of the mare after a prolonged or difficult parturition, or myometra asthenia.[6] In this study, the mean placental retention time was found to vary significantly between certain years of the study. Not surprisingly, this had a significant effect on reproductive efficiency. The differences observed in the mean placental retention time according to year were thought to be associated with variation in breeding circumstances and nutritional conditions which, in turn, were probably influenced by climate and environment. These findings, however, warrant further investigation.

The mean placental retention time in heavy draft breeds of horses has been reported to be longer than that in

Table **7.** Effect of uterine irrigation+antibiotics on the pregnancy rate and number of days from parturition to last mating in mares with different placental retention times.

Placental retention time (hr.)	Pregnancy rate at foaling heat (%)		Mean no. of days from parturition to to last mating (days)	
	Uterine Irrigation +antibiotics	no treatment	uterine irrigation +antibiotics	No treatment
<1 *n*128	28.6[a] *n*7*	69.4[a] *n*85*	35.4 *n*7**	29.7 *n*113**
1<4 *n*143	53.8 *n*13	59.3 *n*86	33.1 *n*19	36.5 *n*115
>4 *n*75	54.5 *n*14	45.7 *n*35	33.9 *n*14	37.2 *n*54

*Number of mares bred at foaling heat.
**Number of mares pregnant on ultrasound examination at 14-40 days.
[a]Pregnancy rate at foaling heat between treatment and control is only group with a placental retention time less than one hour where the difference is significant (p=0.05).

pony mares[5] and several authors have found that the pregnancy rate following breeding at the foaling heat was less than 50%.[2,10] In the present study, the mean pregnancy rate in mares with a placental retention time of less than one hour and in those where the retention time was from one to four hours was 66% and 59.6 %, respectively. The results of this study confirmed that the pregnancy rate decreased with an increased placental retention time after foaling. This may well be due to uterine damage in those mares resulting from the retained placental membranes. It is worth noting that the number of days to establishment of pregnancy increased markedly in mares which had a retained placenta removed manually. Manual removal of the placenta is likely to result in uterine damage and a consequent reduction in pregnancy rate.

Most of the mares which received 50 IU of oxytocin expelled the placenta. However, a few mares developed slight colic after drug administration but returned to normal within a short period of time. The quantity and interval of oxytocin administration should be more thoroughly investigated. The results of this study have shown that subsequent reproductive performance is improved when oxytocin is given immediately after foaling. This may be due to the increased sensitivity of the uterus to oxytocin at this time.

The results of bacteriological examination of a proportion of the mares in this study were not surprising. Many environmental bacteria have been reported in the uterus within the first five days after foaling.[11] In this study uterine swabs were taken from the mares six days after foaling, which is the normal recovery period from contamination. Of the culture positive mares, streptococci were present in the great majority of cases. This finding is in close agreement with previous reports of bacteriological examination of mares with endometritis.[12] Bacteria were present more frequently in the uterus of mares where the placental retention time was longer than eight hours. The mean placental retention time in the mares that were positive on uterine culture was longer than that in the culture negative group. These results indicated that the presence of bacteria was closely associated with a prolonged placental retention time. This is likely an important factor in a decreasing reproductive performance at the foaling heat.

An increased pregnancy rate was observed following uterine irrigation of mares with a placental retention time over four hours and a decreased pregnancy rate was noted following irrigation in mares with a retention time of less than one hour. This suggested that uterine irrigation was effective in improving the pregnancy rate in mares with a longer placental retention time. However, there was no effect on the pregnancy rate when uterine irrigation was administered to mares which had expelled the placenta shortly after parturition. In fact, such treatment may not be without risk in such animals.

CONCLUSIONS

Detailed analysis of the results of this study revealed a relationship between placental retention time after foaling and subsequent reproductive performance in mares belonging to certain heavy draft breeds. The pregnancy rate following breeding at the foaling heat decreased with an increase in the placental retention time. A long placental retention time is likely to cause uterine contamination and endometritis, that finally results in a decrease in reproductive efficiency.

In light of this finding, it is important to ensure that the retained placenta is expelled as soon as possible after foaling. Various oxytocin treatments were effective in promoting expulsion of a retained placenta with a resultant improvement in subsequent reproductive performance.

In summary, the findings of this study confirm that rapid administration of oxytocin at a dosage of 50 IU is the best treatment for the mare with a placental retention time over one hour after foaling. Furthermore, the application of intrauterine treatments based on the presence of bacteria in long-standing cases of placental retention should increase the likelihood that subsequent reproductive performance will not be significantly impaired.

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